FIG. 1

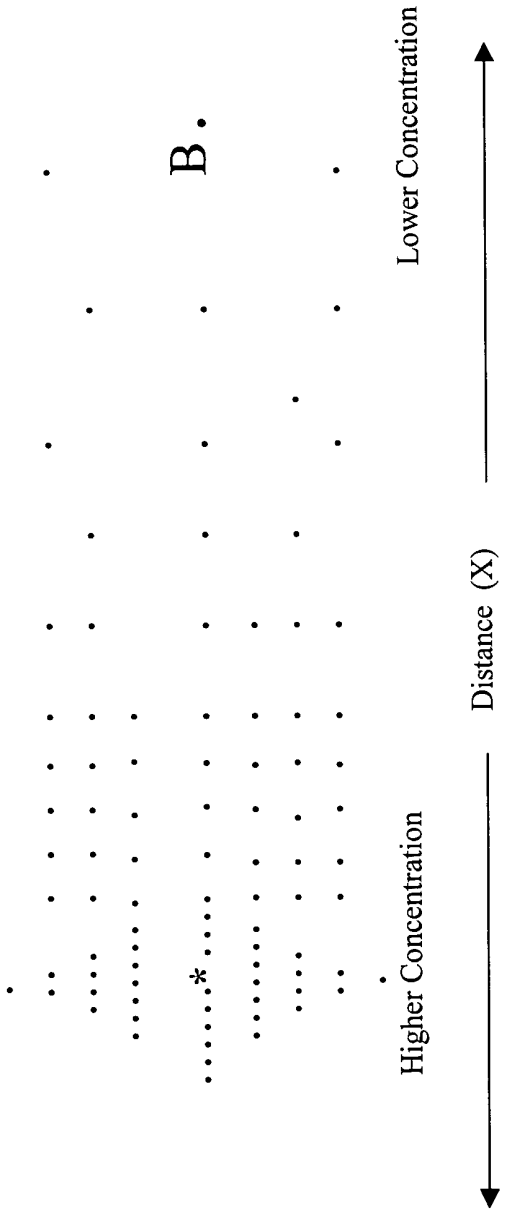


FIG. 2

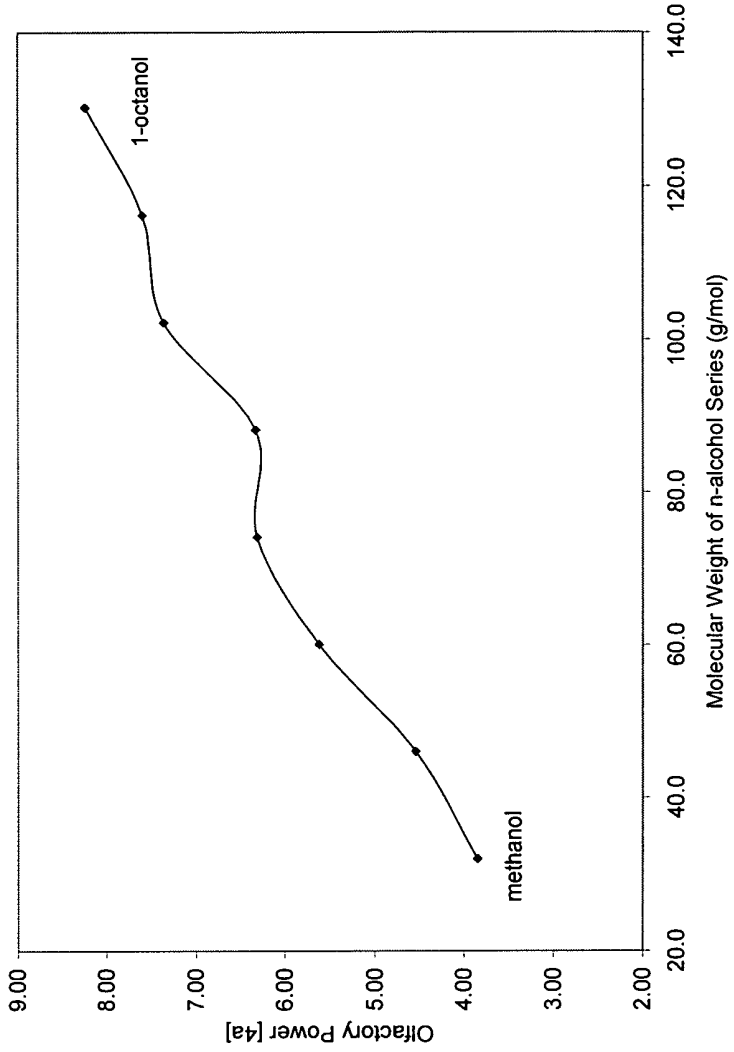

Olfactory Power [4a]
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
20.0
40.0
60.0
80.0
100.0
120.0
140.0
Molecular Weight of n-alcohol Series (g/mol)
1-octanol
methanol

FIG. 3

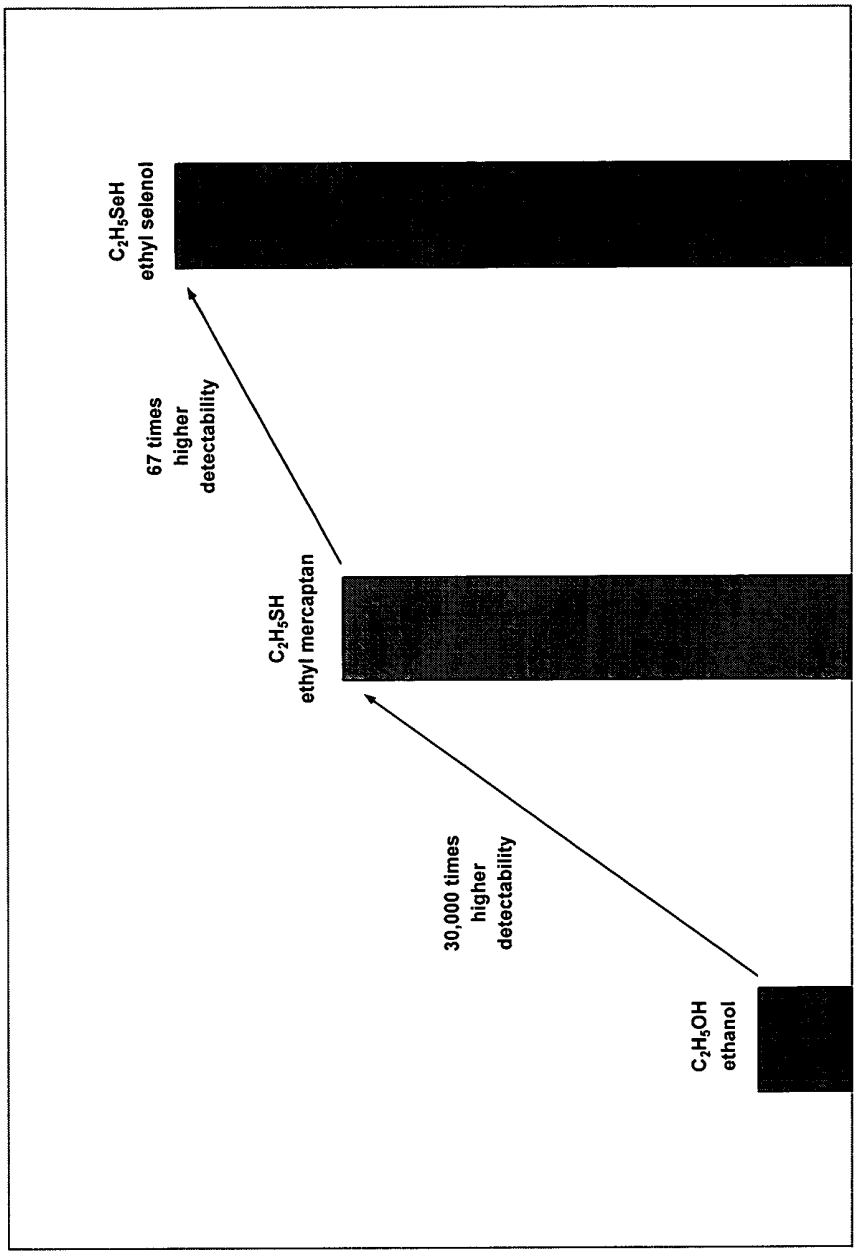

Relative Detectability (arbitrary units)
Group 16 Cogeners
C_2H_5OH
ethanol
30,000 times
higher
detectability
C_2H_5SH
ethyl mercaptan
67 times
higher
detectability
C_2H_5SeH
ethyl selenol

FIG. 4

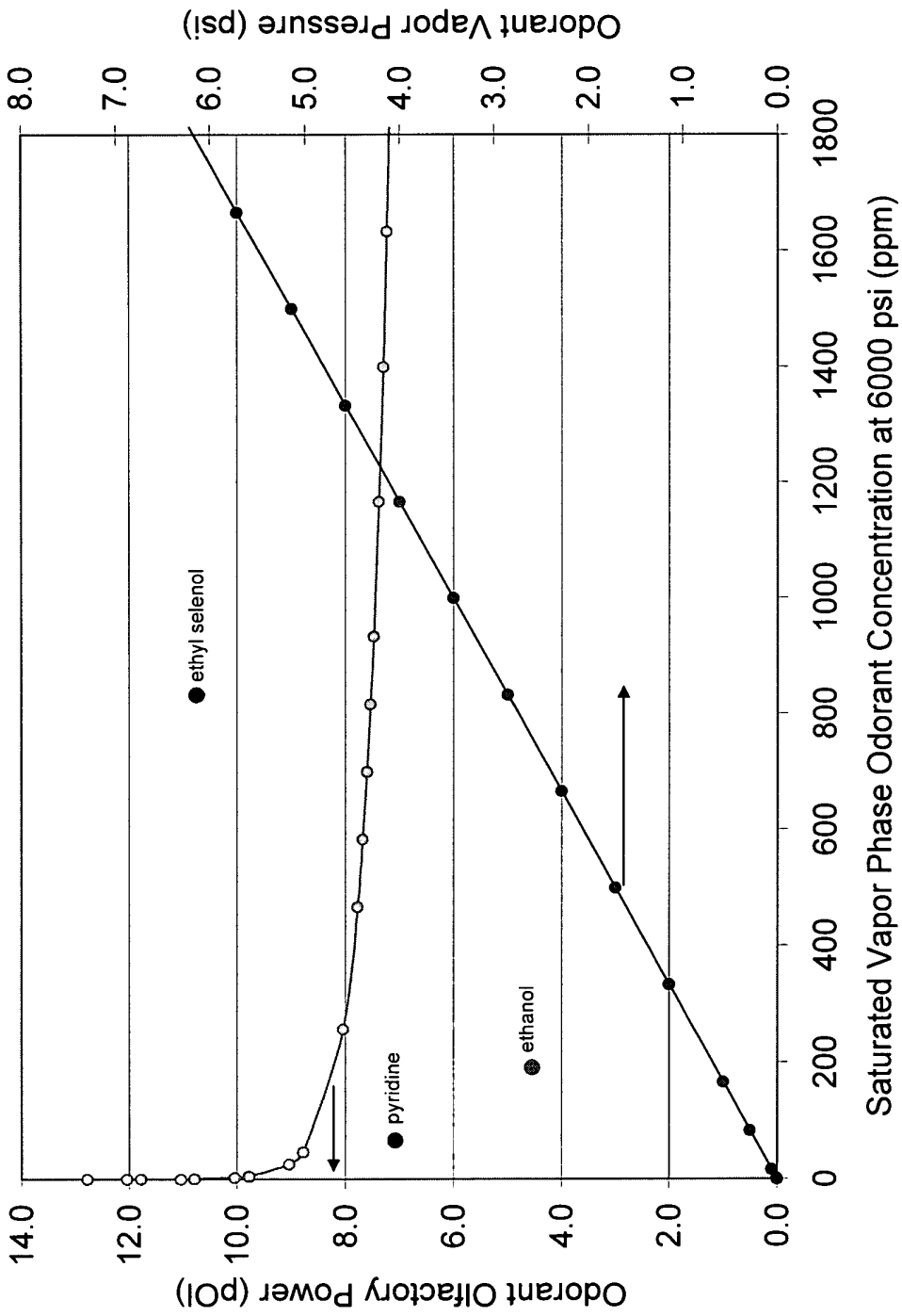

Odorant Olfactory Power (pOl)
Odorant Vapor Pressure (psi)
Saturated Vapor Phase Odorant Concentration at 6000 psi (ppm)
ethyl selenol
pyridine
ethanol
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
0
200
400
600
800
1000
1200
1400
1600
1800

FIG. 5

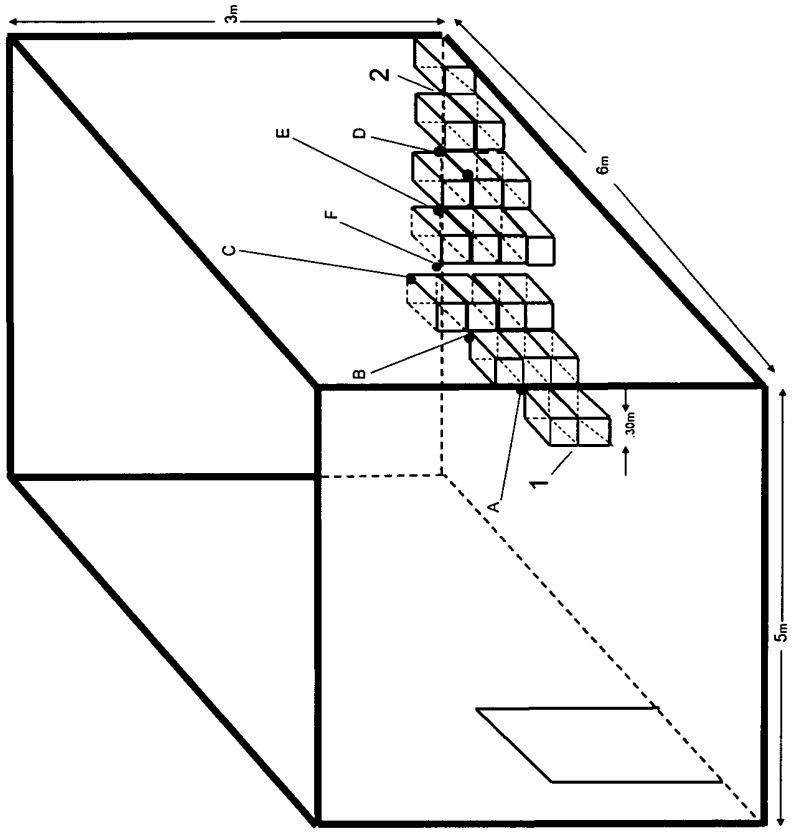


FIG. 6

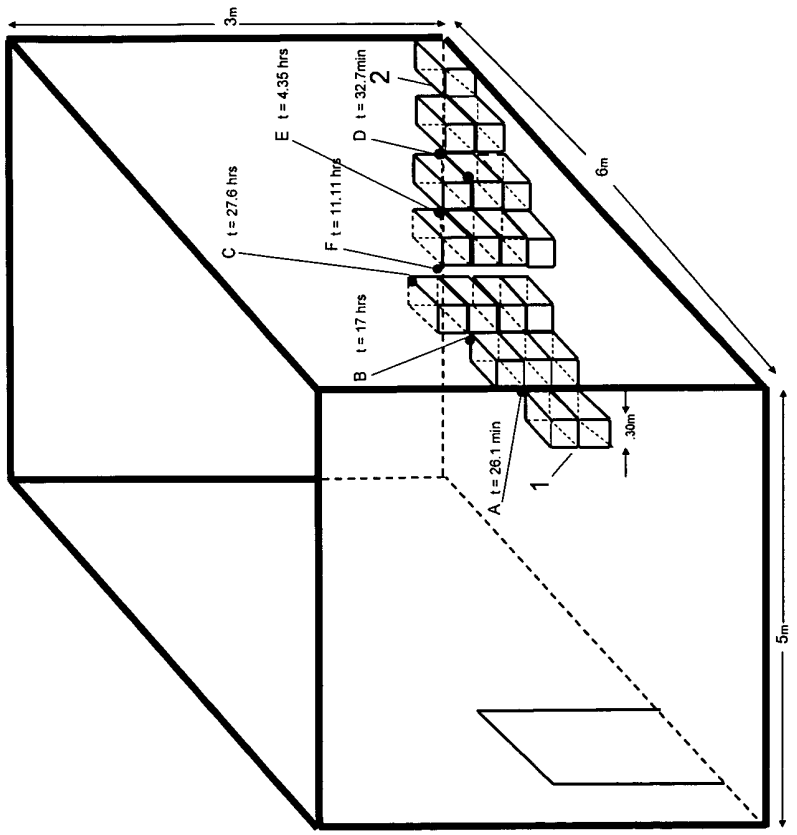

3m
6m
5m
.30m
E t = 4.35 hrs
D t = 32.7min
2
C t = 27.6 hrs
F t = 11.11 hrs
B t = 17 hrs
A t = 26.1 min
1

FIG. 7

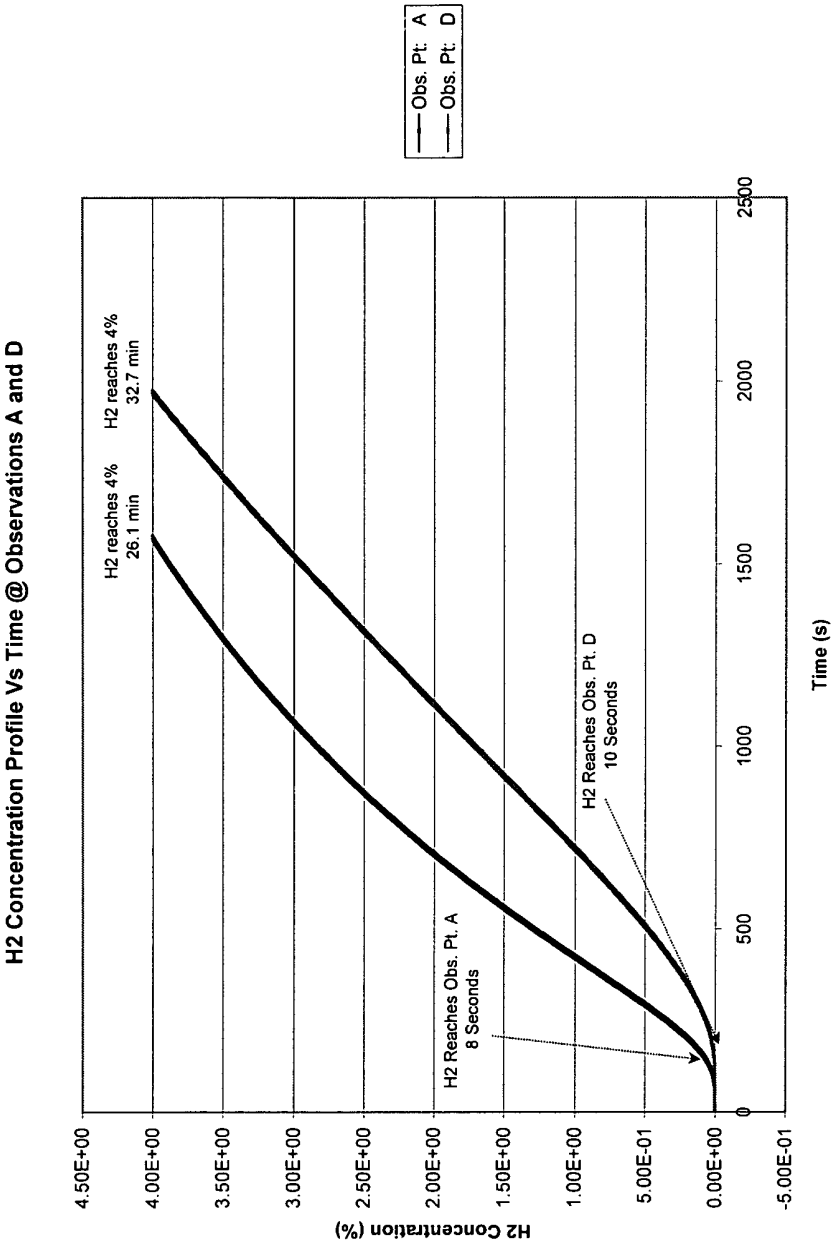

H2 Concentration Profile Vs Time @ Observations A and D
Obs. Pt. A
Obs. Pt. D
H2 reaches 4%
26.1 min
H2 reaches 4%
32.7 min
H2 Reaches Obs. Pt. A
8 Seconds
H2 Reaches Obs. Pt. D
10 Seconds
H2 Concentration (%)
Time (s)
4.50E+00
4.00E+00
3.50E+00
3.00E+00
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
-5.00E-01
0
500
1000
1500
2000
2500

FIG. 8

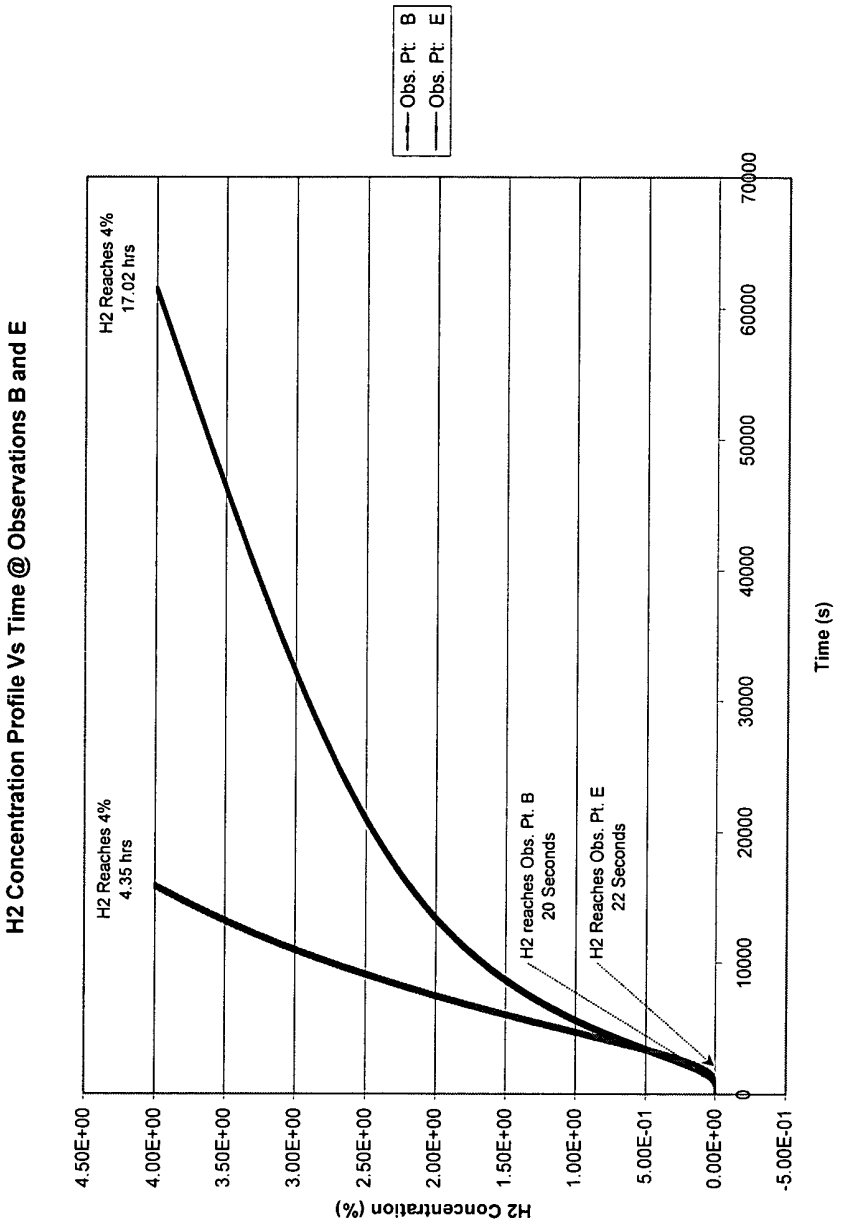

H2 Concentration Profile Vs Time @ Observations B and E
Obs. Pt: B
Obs. Pt: E
H2 Reaches 4%
4.35 hrs
H2 Reaches 4%
17.02 hrs
H2 reaches Obs. Pt. B
20 Seconds
H2 Reaches Obs. Pt. E
22 Seconds
H2 Concentration (%)
4.50E+00
4.00E+00
3.50E+00
3.00E+00
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
-5.00E-01
0
10000
20000
30000
40000
50000
60000
70000
Time (s)

FIG. 9

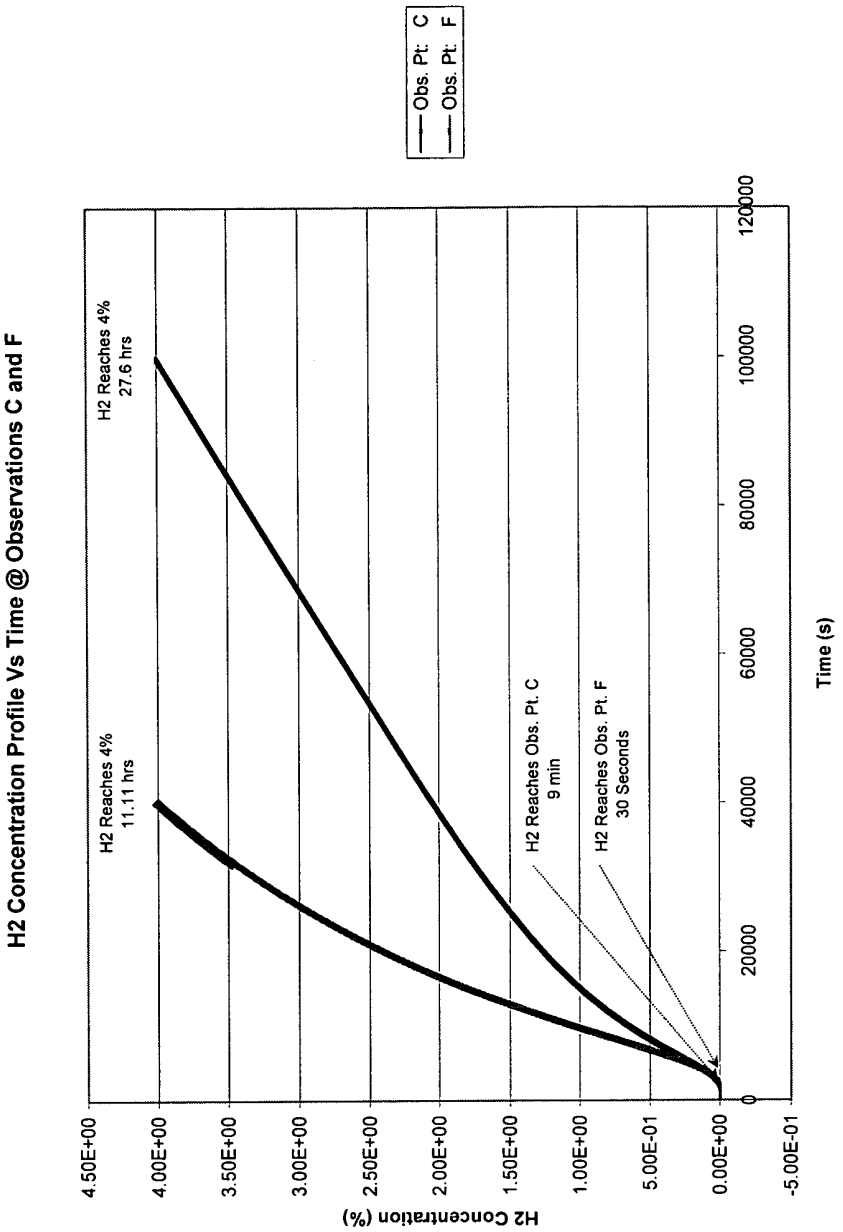
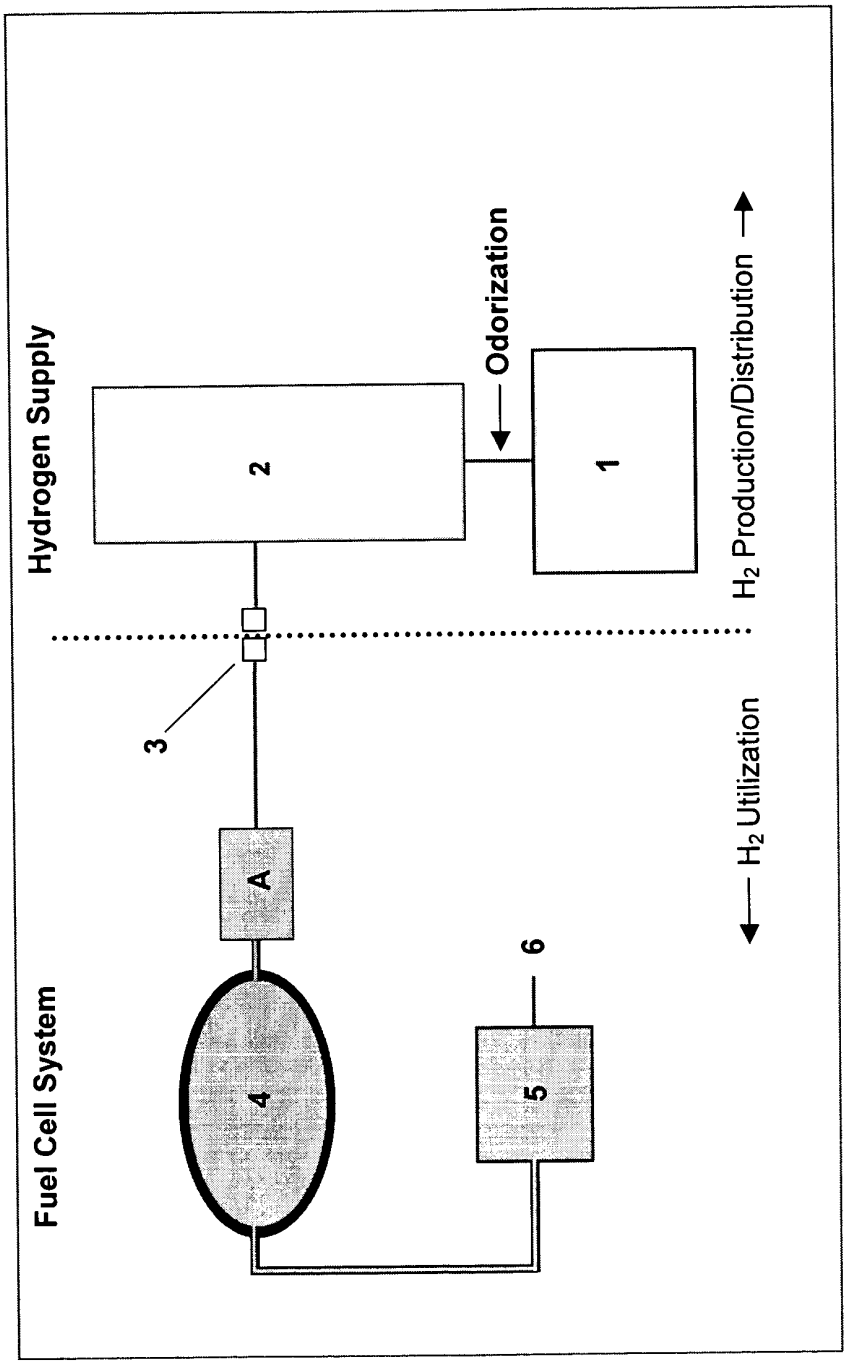
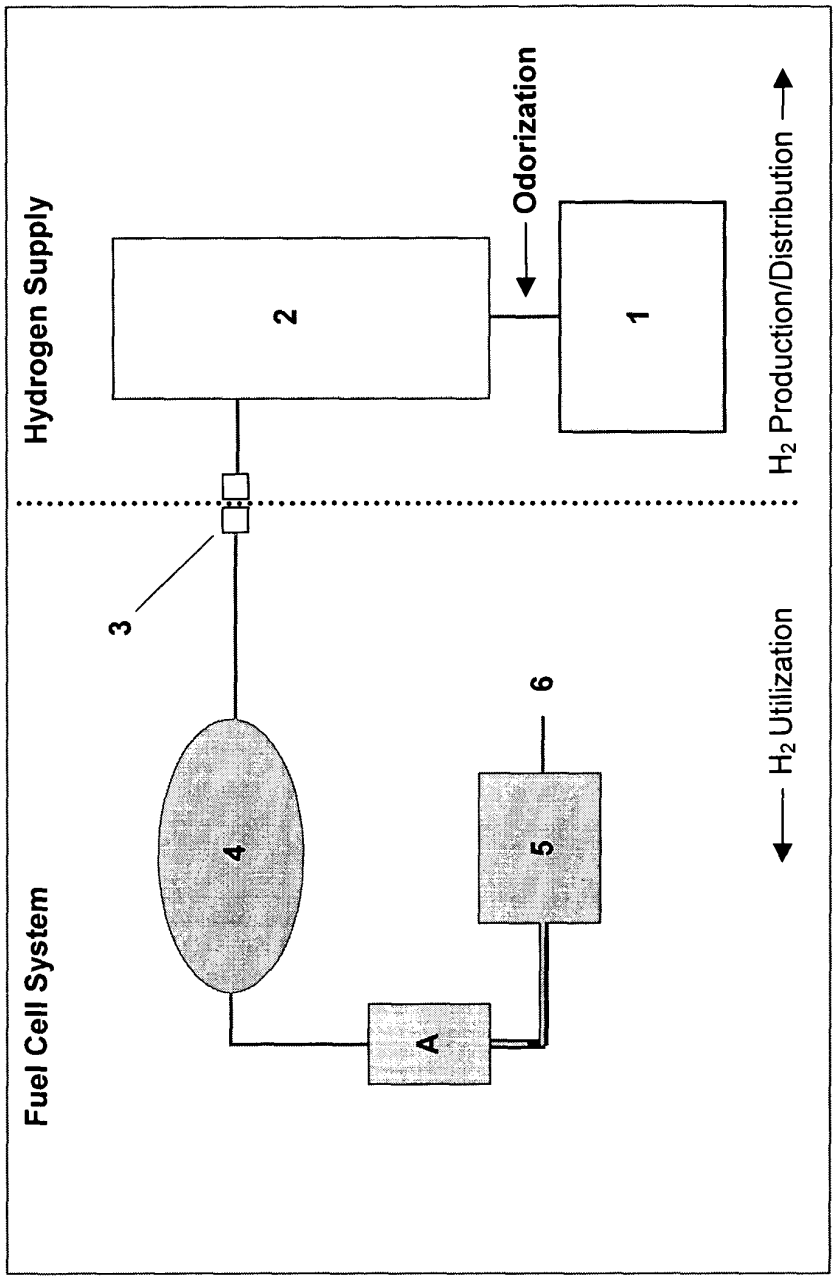

H2 Concentration Profile Vs Time @ Observations C and F
Obs. Pt: C
Obs. Pt: F
H2 Reaches 4%
11.11 hrs
H2 Reaches 4%
27.6 hrs
H2 Reaches Obs. Pt. C
9 min
H2 Reaches Obs. Pt. F
30 Seconds
H2 Concentration (%)
4.50E+00
4.00E+00
3.50E+00
3.00E+00
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
-5.00E-01
0
20000
40000
60000
80000
100000
120000
Time (s)

FIG. 10



1 - Hydrogen production
2 - Supplier hydrogen storage (compressed gas)
3 - Mobile system or stationary system connector
4 - On-board, on-site high pressure hydrogen storage
5 - Fuel cell stack
6 - Odorant 'free' exhaust
A - Odorant adsorbers

FIG. 11



1 - Hydrogen production
2 - Supplier hydrogen storage (compressed gas)
3 - Mobile system or stationary system connector
4 - On-board, on-site high pressure hydrogen storage
5 - Fuel cell stack
6 - Odorant 'free' exhaust
A - Odorant adsorbers

FIG. 12

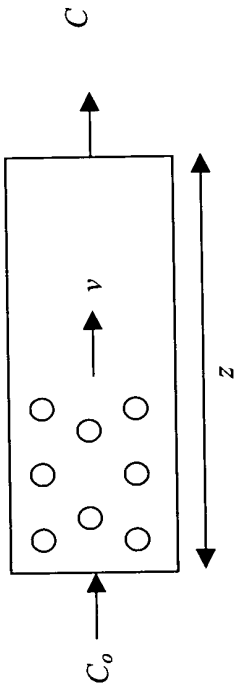


FIG. 13

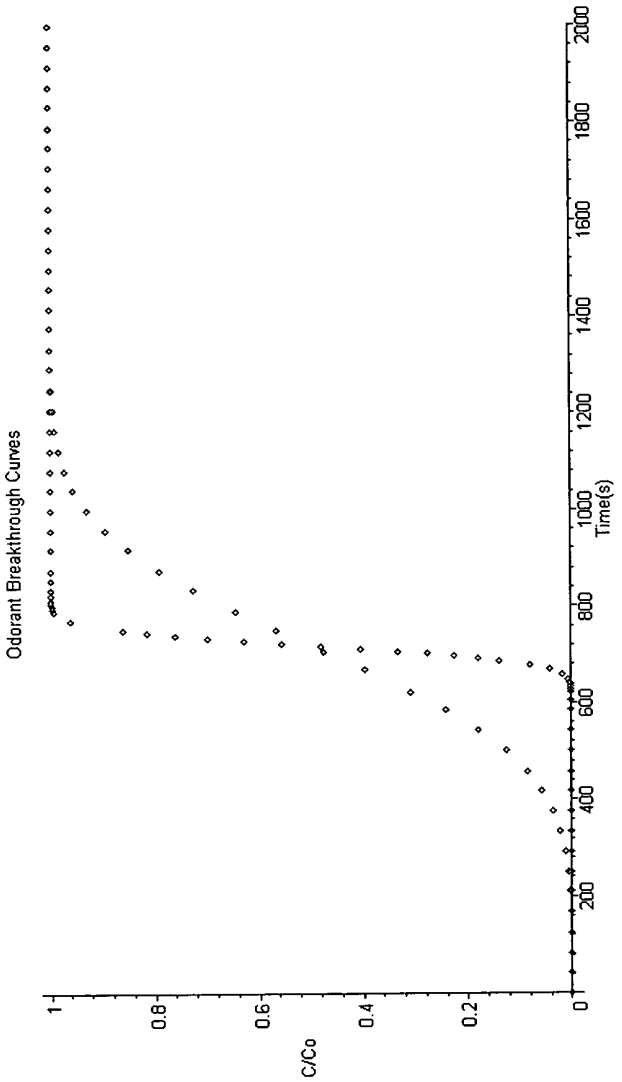

Odorant Breakthrough Curves
C/Co
Time(s)
0
0.2
0.4
0.6
0.8
1
200
400
600
800
1000
1200
1400
1600
1800
2000

FIG. 14

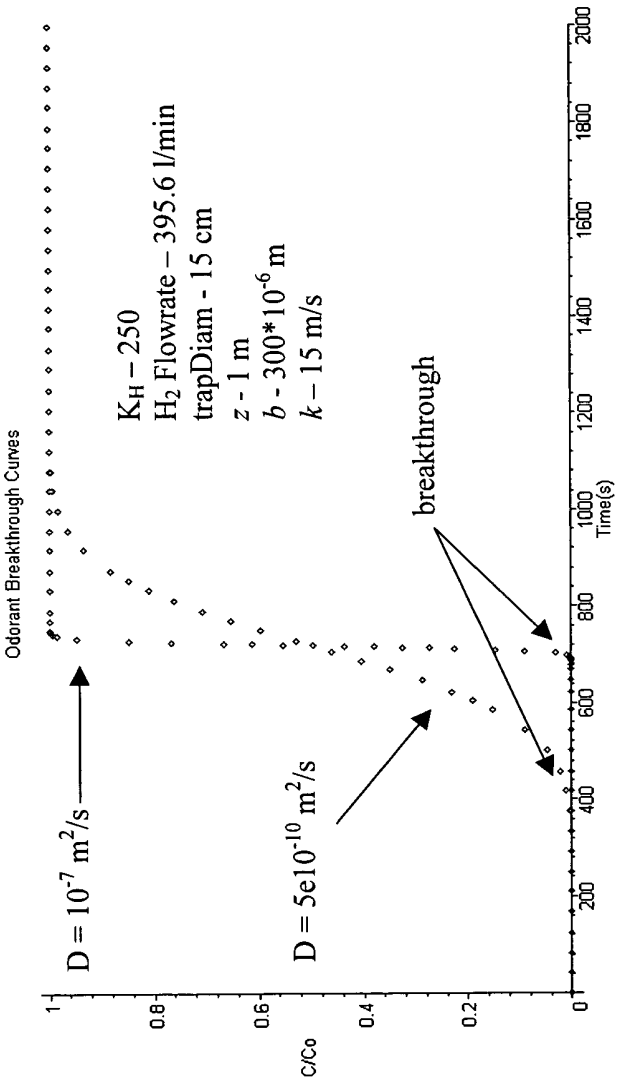

Odorant Breakthrough Curves
K_H – 250
H_2 Flowrate – 395.6 l/min
trapDiam - 15 cm
z - 1 m
b - 300*10^{-6} m
k – 15 m/s
D = 10^{-7} m^2/s
D = 5e10^{-10} m^2/s
breakthrough
C/Co
Time(s)
0
0.2
0.4
0.6
0.8
1
200
400
600
800
1000
1200
1400
1600
1800
2000

FIG. 15

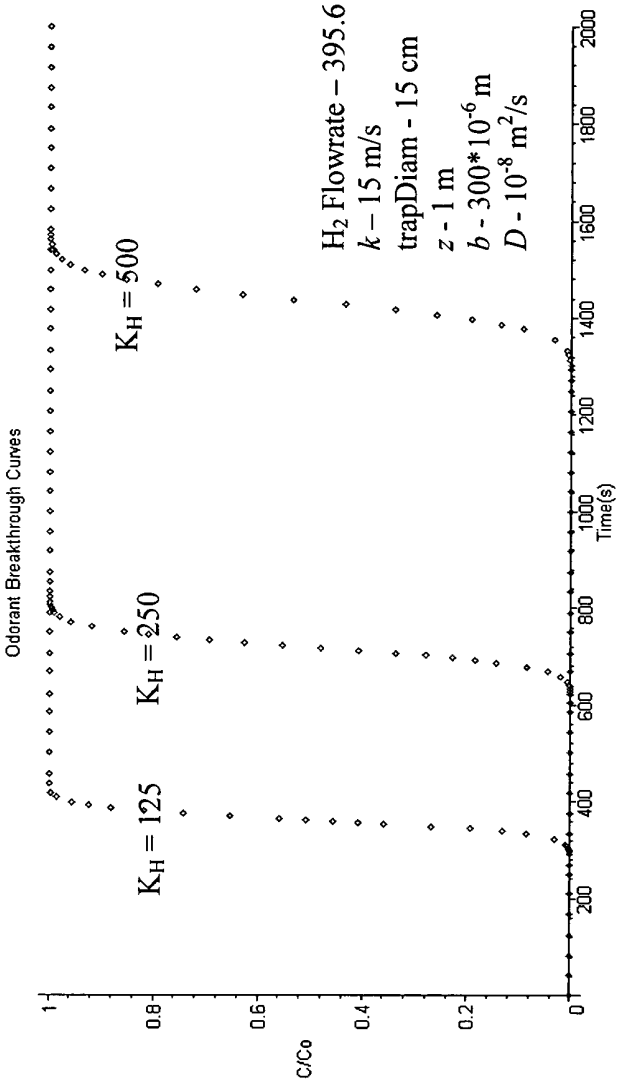

Odorant Breakthrough Curves
$K_H = 125$
$K_H = 250$
$K_H = 500$
H_2 Flowrate – 395.6 l/min
k – 15 m/s
trapDiam - 15 cm
z - 1 m
b - 300*10^{-6} m
D - 10^{-8} m^2/s
C/Co
Time(s)
0
0.2
0.4
0.6
0.8
1
200
400
600
800
1000
1200
1400
1600
1800
2000

FIG. 16

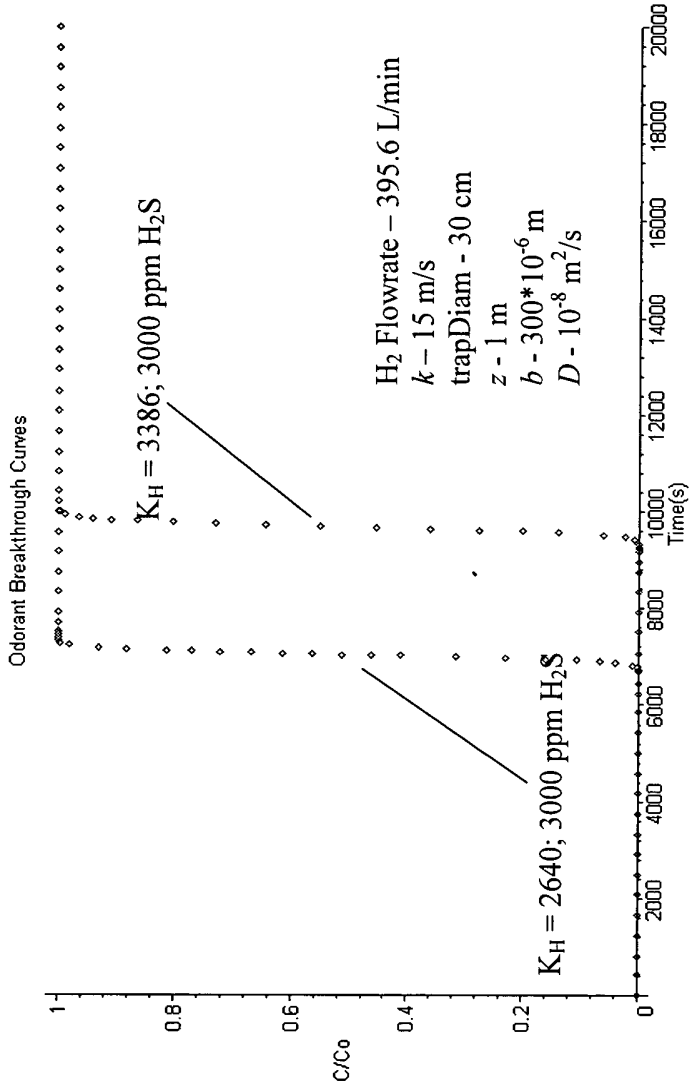
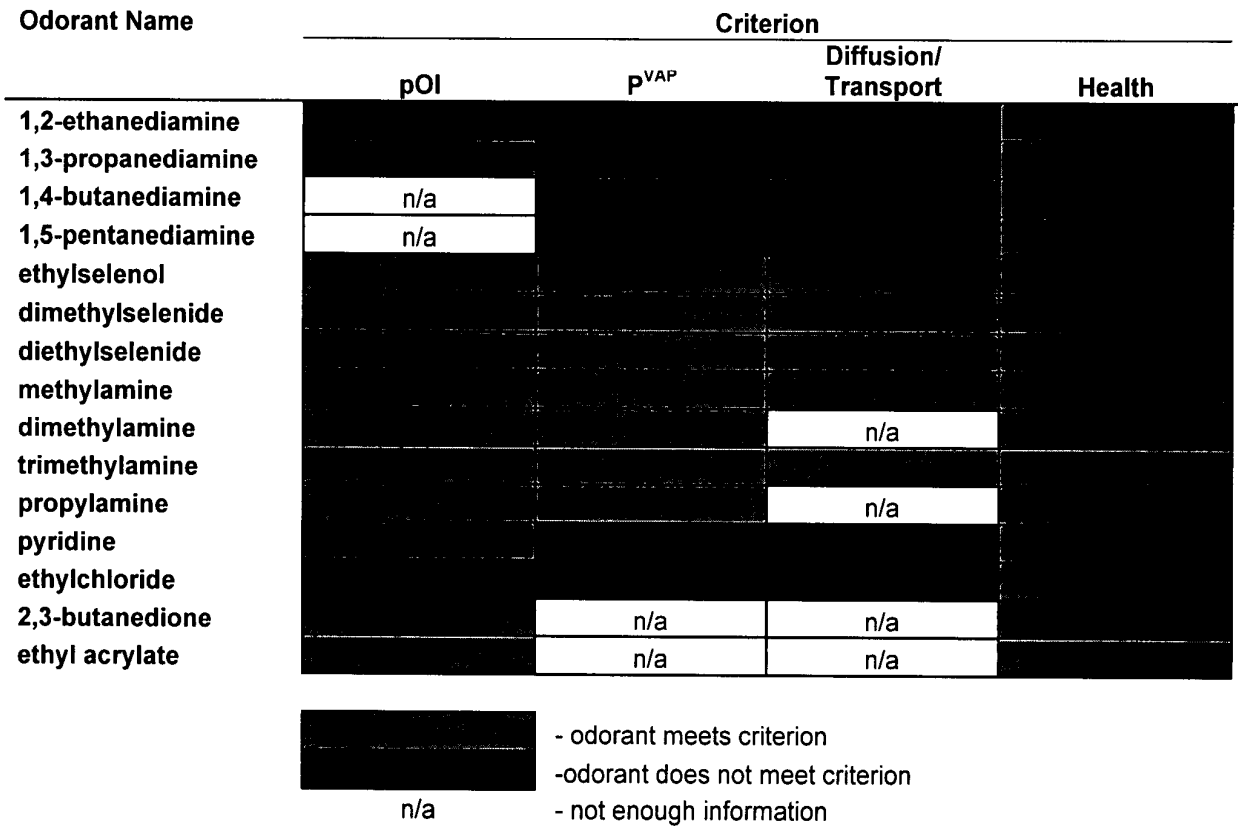

Odorant Breakthrough Curves
K_H = 3386; 3000 ppm H_2S
K_H = 2640; 3000 ppm H_2S
H_2 Flowrate – 395.6 L/min
k – 15 m/s
trapDiam - 30 cm
z - 1 m
b - 300*10^{-6} m
D - 10^{-8} m^2/s
C/Co
Time(s)
0
0.2
0.4
0.6
0.8
1
2000
4000
6000
8000
10000
12000
14000
16000
18000
20000

FIG. 17


Odorant Name
Criterion
pOI
P^{VAP}
Diffusion/ Transport
Health
Keep as Candidate?
1,2-ethanediamine
No
1,3-propanediamine
No
1,4-butanediamine
n/a
No
1,5-pentanediamine
n/a
No
ethylselenol
Yes
dimethylselenide
Yes
diethylselenide
Yes
methylamine
Yes
dimethylamine
n/a
?
trimethylamine
Yes
propylamine
n/a
?
pyridine
No
ethylchloride
No
2,3-butanedione
n/a
n/a
?
ethyl acrylate
n/a
n/a
?
- odorant meets criterion
-odorant does not meet criterion
n/a
- not enough information